What is the relationship between breakfast and adiposity in children?

Conclusion

Moderate evidence suggests that children who do not eat breakfast are at increased risk of overweight and obesity. The evidence is stronger for adolescents. There is inconsistent evidence that adults who skip breakfast are at increased risk for overweight and obesity.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades, click here.

Evidence Summary Overview

The literature review identified 15 studies: One randomized controlled trial (RCT) (Rosado, 2008), one non-randomized controlled trial (Ask, 2006) and 13 prospective cohort studies (Affenito, 2005; Albertson, 2007; Albertson, 2009; Barton, 2005; Berkey, 2003; Crossman, 2006; Elgar, 2005; Haines, 2007; Merten, 2009; Neumark-Sztainer, 2007; Niemeier, 2006; Timlin, 2008; Wengreen, 2009). The majority of studies defined breakfast as an eating occasion that occurred between5 a.m. and 10 a.m. on weekdays and 5 a.m. and 11 a.m. on weekends. The studies were conducted in the US, Mexico, Norway and the United Kingdom. Studies ranged in sample size from 54 (Ask, 2006) to 14,586 (Berkey, 2003) and three studies included only girls (Affenito, 2005; Albertson, 2007; Barton, 2005). Nine studies found an inverse relationship between breakfast consumption and body weight in children (Ask, 2006; Albertson, 2007; Barton, 2005; Crossman, 2006; Elgar, 2005; Haines, 2007; Merten, 2009; Niemeier, 2006; Timlin, 2008). One study found an inverse relationship only among children with a BMI>95th percentile (Albertson, 2007). Two studies found an inverse relationship in boys only, and no relationship in girls (Albertson, 2009; Crossman, 2006) and one study found an inverse relationship in girls only, and no relationship in boys (Neumark-Sztainer, 2007). Only one study found no relationship between breakfast consumption and body weight in children (Albertson, 2009). One study found no relationship with breakfast alone, but an inverse relationship with breakfast combined with a nutrition education program (Rosado, 2008). Two studies initially found an inverse relationship, but after adjusting for potential confounders, the relationship was no longer significant (NS) (Affenito, 2005; Timlin, 2008). One study found no relationship with breakfast, but found an inverse relationship between cereal consumption and adiposity (Barton, 2005). One study found a positive relationship between breakfast consumption and body weight in Freshman college students (Wengreen, 2009). One study found a positive relationship between breakfast consumption and body weight in overweight children, and an inverse relationship in normal-weight children (Berkey, 2003).

The Committee did not review the literature on the use of breakfast consumption as a tool for adults actively losing weight.

Evidence summary paragraphs:

Randomized Controlled Trials (1)

Rosado J et al, 2008 (positive quality) conducted a RCT in Mexico to determine if consuming ready-to-eat cereal is an effective strategy to reduce body weight in overweight or at risk of overweight children. Subjects were randomly assigned to one of four different treatments for 12 weeks:

1. One serving of cereal for breakfast
2. One serving of cereal for breakfast and another one for dinner
3. One serving of cereal for breakfast and a nutrition education program
4. A non-intervention control group. Compliance with study protocol was assessed via weekly parent interviews and weight and body composition (bioelectrical impedance) was assessed at baseline and 12 weeks.

The final sample included 178 subjects (ages six-12 years, mean body mass index (BMI)=24kg/m^2). Attrition rate was 32% after 12 weeks. After 12 weeks, only children who consumed one serving of cereal at breakfast with a nutrition education program had significantly lower body weight (-1.01kg (-1.69, -0.34), P<0.01), lower BMI (-0.95kg/m^2 (-1.71, -0.20), P<0.01), and lower total body fat (-0.71% (-1.71, 0.28), P<0.05) compared with the control group. The authors concluded that increasing cereal consumption at breakfast is only effective for weight loss when combined with a nutrition education program.

Non-randomized Controlled Trials (1)

Ask A et al, 2006 (positive quality) conducted a non-randomized controlled trial in Norway to evaluate if breakfast serving in a lower secondary school could improve body mass index among students. All students in 10th grade, consisting of two classrooms, were invited to participate in the study. Students in one class were offered a free breakfast at the beginning of the school day for four months, while students in the second class served as controls. Students completed a food frequency questionnaire (FFQ) and had their height, weight and BMI measured at baseline and four months. The final sample included 54 subjects (26 in the intervention class and 28 in the control class). After the four-month intervention period, weight and BMI increased significantly in the control group (P<0.01 for weight, P<0.05 for BMI). There was also a significance increase in weight in the males in the intervention group (P<0.05), but not in the females. BMI did not change significantly in the intervention group. The authors concluded that breakfast consumed in the classroom for four months reduced weight gain among adolescent students.

Cohort Studies (13)

Affenito S et al, 2005 (positive quality) conducted a prospective cohort study in the United States to examine the association between breakfast intake and BMI. Subjects were participants from the nine-year longitudinal National Growth and Health Study. Breakfast intake was determined using annual three-day food records, and height, weight and BMI were measured each year. The final sample included 2,379 girls who were non-Hispanic white or black and aged nine to 10 years at baseline. After adjusting for site, race and age, days of breakfast consumption was a significant predictor of BMI (P<0.005), girls who ate breakfast more consistently had lower BMI. Girls who ate cereal all three days had a BMI about 0.1 point lower than did girls who ate cereal zero, one or two days (P<0.05). However, after adjusting for parental education, physical activity and energy intake, the effect of breakfast was not significant any longer.

Albertson A et al, 2007 (positive quality) conducted a prospective cohort study in the United States to examine associations between breakfast eating over time and BMI. Subjects were participants in the nine-year longitudinal National Growth and Health Study and were nine to 10 years old at

baseline and 19 years at the end of the study. Breakfast intake and dietary intake data were collected annually using three-day food records, and breakfast was defined as any eating that occurred between 5:00 and 10:00 a.m. on weekdays, 11:00 a.m. on weekends. Weight, height and BMI were also measured annually, and BMI-for-age z scores were calculated. The final sample included 2,371 girls who were non-Hispanic black or white. Breakfast history (percent days eating breakfast) was not significantly associated with BMI z scores. However, breakfast history by baseline BMI-for-age was significantly associated with BMI z scores (P<0.0001), indicating that the interaction between BMI and breakfast was dependent on baseline BMI. Among girls with a high BMI at baseline, those who ate breakfast more often had lower BMI at year 10, compared to those who ate breakfast less often. For girls with a baseline BMI at the 95th percentile, eating breakfast one more day per week was associated with a significant decrease of -0.04 (95% CI -0.08, -0.01) in BMI at year 10 (P=0.04) and for those at the 97th percentile, eating breakfast one more day per week was association with a -0.05 (95% CI -0.10, -0.01, P=0.01) decrease in BMI. The authors concluded that regular breakfast consumption over time moderated body weight among girls who had relatively high BMI at baseline.

Albertson A et al, 2009 (positive quality) analyzed prospective cohort data from a group of children participating in an RCT in the United States to examine the effects on ready-to-eat cereal and breakfast consumption on BMI. Children, participants in the Dietary Intervention Study in Children, were ages eight to 10 years at baseline, and were followed for 7.5 years, with data collected at baseline, years one, three, five and 7.5. Subjects' dietary intake, including cereal and breakfast intake, was assessed at each visit using three non-consecutive 24-hour recalls, with the first completed face-to-face and the second and third via telephone. Height, weight and BMI were assessed at each visit. The final sample included 650 children (354 boys, 296 girls, 87% white). For the association between days of cereal consumption and BMI, the linear trend was significant in boys (P=0.02) indicating that lower BMI was associated with more days of cereal consumption. Boys who consumed zero days of cereal had a BMI of 20.4 kg/m^2, while boys who consumed three days of cereal had a BMI of 20.1kg/m^2 (P=0.008, d=0.147). The trend for girls was not significant. There was also no significant association between BMI z scores and frequency of cereal consumption for boys (P=0.18) or girls (P=0.45). The relationship between breakfast and BMI was not tested, but the authors noted that cereal was predominantly consumed at breakfast in this sample.

Barton B et al, 2005 (positive quality) analyzed prospective cohort data from the United States to examine the association between breakfast and cereal intake with BMI. Subjects were participants from the nine-year longitudinal National Growth and Health Study. Breakfast intake was determined using annual three-day food records, and height, weight and BMI were measured each year. The final sample included 2,379 girls who were non-Hispanic white or black, and aged nine to 10 years at baseline. Days eating cereal was predictive of BMI z scores as well as risk of overweight (P<0.01), but days eating breakfast was not predictive of BMI z scores or weight status (P>0.17). For BMI z scores and risk of overweight, girls who ate cereal on three days had lower scores than did girls who ate cereal zero, one or two days (P<0.05), while girls who ate cereal zero, one or two days did not differ from one another. Body mass index z scores decreased 0.015 for each additional day eating cereal (P<0.001). Compared with girls who ate cereal on zero days, girls who ate cereal on one two or three days were 0.93, 0.90 and 0.87 times as likely to be at risk of overweight, so eating cereal one or more days reduced the risk of overweight. The authors concluded that cereal consumption was association with lower BMI and improved weight status, while breakfast consumption was not associated with these indicators of weight.

Berkey C et al, 2003 (neutral quality) used data from a cohort study in the United States to examine whether skipping breakfast was prospectively associated with changes in body fatness. Subjects were participants in the Growing Up Today Study, which began in 1996 when children were nine to 14 years old. This study investigated data collected in 1996, 1997 and 1998, looking at both

cross-sectional and longitudinal effects of breakfast on weight. Children self-reported their height and weight annually, BMI was calculated and change in BMI over time was determined. An annual questionnaire was used to assess breakfast skipping: Children were asked "How many time each week do you eat breakfast?" The final sample included 14,586 adolescents (ages nine to 17 years). Cross-sectionally, skipping breakfast was associated with overweight: Children who never ate breakfast were heavier (26.4% of boys and 25.3% of girls who never ate breakfast were overweight) than those who ate breakfast nearly every day (21.2% of boys and 15.8% of girls who regularly ate breakfast were overweight). Prospectively, overweight children who never ate breakfast lost BMI over the following year compared to overweight children who ate breakfast nearly every day (boys: -0.66kg/m^2; girls: -0.50kg/m^2). However, normal weight children who never ate breakfast gained weight relative to peers who ate breakfast nearly every day (boys: +0.21kg/m^2; girls: +0.08kg/m^2). The authors concluded that overweight children who never eat breakfast may lose body fat over time, but normal weight children do not.

Crossman A et al, 2006 (positive quality) used prospective cohort data from the United States to examine the effects of adolescents' behaviors, including breakfast consumption, on their weight status six years later. Subjects were participants in the National Longitudinal Study of Adolescent Health. This study includes only respondents who participated in Wave One (1995; ages 12-18years) and Wave Three (2001-2002; ages 18-26 years). Height and weight were self-reported at Wave One, and measured at Wave Three and BMI and weight status were calculated. Subjects reported whether or not they eat breakfast. The final sample included 6,378 subjects (3,144 males and 3,234 females). Skipping breakfast during adolescence predicted male weight in young adulthood, but it was not significant for females. Males who skipped breakfast during adolescence were more likely to be overweight or obese six years later (OR=1.37, P<0.05).

Elgar F et al, 2005 (positive quality) analyzed data from a cohort study in the United Kingdom to determine the effects on overweight and obesity of breakfast consumption. Participants were from the Health Behaviour of School-aged Children Study that took place between 1994 and 1998. Measurements were collected on two occasions four years apart. Height and weight measurements were taken at baseline and year four, and subjects completed a questionnaire at the same time-points that included a question about breakfast consumption. The final sample included 355 subjects (mean age at baseline=12 years). Breakfast skipping reported at baseline was related toBMI at year four. Adolescents who reported skipping breakfast were more likely to have an increase in BMI four years later (P<0.05). The authors concluded that skipping breakfast was positively associated with increased weight over time.

Haines J et al, 2007 (positive quality) used prospective cohort data from the United States to examine factors associated with weight status of adolescents, including frequency of breakfast consumption. Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed up five years later (2003-2004). Body mass index was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a food frequency questionnaire (FFQ), which included a question regarding the number of days over the past week breakfast was consumed. The final sample included 2,516 subjects (1,386 girls, 1,130 boys). For both girls and boys, breakfast consumption at baseline was negatively associated with overweight at year five (girls: OR=0.89, 95% CI 0.83, 0.97; boys: OR=0.89, 95% CI 0.82, 0.97; P<0.05) for both. The authors concluded that consuming breakfast during adolescence was protective against weight gain over time.

Merten M et al, 2009 (positive quality) conducted a prospective cohort study in the United States to assess breakfast consumption patterns and obesity status during adolescence and young adulthood. Subjects were participants in the National Longitudinal Study of Adolescent Health. Subjects were

assessed at two developmental time points, adolescence (Wave Two) and young adulthood (Wave Three). Subjects were asked about their frequency of breakfast consumption, and subjects who reported consuming breakfast at least four days a week were considered to be regular breakfast consumers. Self-reported height and weight was used to calculate BMI and those who were obese during adolescence and young adulthood were considered to have chronic obesity. The final sample included 7,788 subjects with complete data from Waves Two and Three. Wave Two subjects were adolescents ranging in age from 11-18 years (mean age=16.1 years). Results showed that 59% of adolescents were regular breakfast consumers. Chronic obesity was significantly associated with a decrease in the likelihood of adolescent breakfast consumption (OR=0.59; 95% CI: 0.52 to 0.68; P<0.001). The authors concluded that regular breakfast consumption was protective against obesity.

Neumark-Sztainer D et al, 2007 (neutral quality) used longitudinal cohort data from the United States to examine dieting behaviors and weight status over time in adolescents. Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed up five years later (2003-2004). Body mass index was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a food frequency questionnaire, which included a question regarding the number of days over the past week breakfast was consumed. The final sample included 2,516 subjects (1,386 girls, 1,130 boys). In girls, frequency of breakfast consumption was associated with decreases in BMI (-0.11 BMI units, P=0.013). Frequency of breakfast consumption was not associated with BMI in boys.

Niemeier H et al, 2006 (positive quality) conducted a prospective cohort study in the United States and investigated whether breakfast skipping was associated with weight during the transition from adolescence to adulthood. Subjects were participants in the National Longitudinal Study of Adolescent Health. Subjects were assessed at two developmental time-points, adolescence (Wave Two) and young adulthood (Wave Three). Subjects were asked about their frequency of breakfast consumption, with responses ranging from zero to seven days per week. Measured height and weight was used to calculate BMI. The final sample included 9,919 subjects with complete data from Waves Two and Three (Wave Two included ages 11-18 years, mean BMI=22kg/m^2; Wave Three included ages 18 and 26 years, mean BMI=26kg/m^2). Breakfast consumption at Wave Two predicted zBMI at Wave Three (β= -0.01, P<0.05). For each additional day of breakfast consumption during Wave Two, zBMI was predicted to decrease 0.01 at Wave Three (P<0.01). Breakfast consumption and change in breakfast consumption accounted for 0.06% of the variance in zBMI at Wave Three. The authors concluded that breakfast skipping was associated with increased weight gain from adolescence to adulthood.

Timlin M et al, 2008 (positive quality) used longitudinal cohort data from the United States to examine the association between breakfast frequency and weight change over time in adolescents. Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed up five years later (2003-2004). Body mass index was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a FFQ, which included a question regarding the number of days over the past week breakfast was consumed. The final sample included 2,216 subjects (1,215 girls, 1,007 boys; mean age at baseline=15 years). At both baseline and five years, cross-sectional analyses showed that daily breakfast-eaters had lower BMI than those who ate breakfast intermittently or never (P<0.01). Prospective analyses showed that the frequency of eating breakfast was inversely associated with BMI in a dose-response manner (P<0.01). Body mass index increased 1.6±0.16 among daily breakfast-eaters, 2.0±0.09 in intermittent eaters and 2.2±0.19 in those who never ate breakfast. However, after adjusting for psychosocial variables related to weight, this association was no longer significant. The authors concluded that breakfast consumption was protective against

weight gain over time in adolescents.

Wengreen H et al, 2009 (positive quality) conducted a longitudinal observational study in the United States to examine changed in weight, dietary intake and health-related behaviors among first-year college students. Subjects were participants in the Freshmen Health Study. Weight was measured at the beginning and end of the fall semester (August-December 2005). Subjects also completed questionnaires about dietary intake and health-related behaviors during the last six months of high school (January-June 2005), in August 2005, and during their first semester of college (August-December 2005) in December 2005. The final sample included 159 subjects (102 women, 57 men; mean BMI=23kg/m^2). Participants who gained ≥5% of body weight (N=36) were more likely to eat breakfast regularly (at least four times per week) during their first three months of college than during high school compared to those who did not gain ≥5% of body weight (P<0.05). The authors concluded that students who increased their breakfast intake during freshman year of college gained more weight than those who did not.

View table in new window

Author, Year, Study Design, Class, Rating	Participants	Methods	Outcomes
Affenito SG et al 2005 Study Design: Longitudinal Cohort Study Class: B Rating:	N=2,379 girls (non-Hispanic white or black). Age: Nine to 10 years at baseline. Location: United States.	Subjects were participants from the nine-year longitudinal National Growth and Health Study. Breakfast intake was determined using annual three-day food records, and height, weight and BMI were measured each year.	After adjusting for site, race and age, days of breakfast consumption was a significant predictor of BMI (P<0.005), girls who ate breakfast more consistently had lower BMI. Girls who ate cereal all three days had a BMI about 0.1 point lower than did girls who ate cereal zero, one or two days (P<0.05). However, after adjusting for parental education, physical activity and energy intake, the effect of breakfast was NS any longer.

Albertson et al 2007 Study Design: Prospective cohort study Class: B Rating:	N=2,371 girls (non-Hispanic black or white). Location: United States.	Subjects were participants in the nine-year longitudinal National Growth and Health Study, and were nine to 10 years old at baseline and 19 years at the end of the study. Breakfast intake and dietary intake data were collected annually using three-day food records, and breakfast was defined as any eating that occurred between 5:00 and 10:00 a.m. on weekdays, 11:00 a.m. on weekends. Weight, height and BMI were also measured annually, and BMI-for-age z scores were calculated.	Breakfast history (percent days eating breakfast) was NS associated with BMI z scores. However, breakfast history by baseline BMI-for-age was significantly associated with BMI z scores (P<0.0001), indicating that the interaction between BMI and breakfast was dependent on baseline BMI. Among girls with a high BMI at baseline, those who ate breakfast more often had lower BMI at year 10, compared to those who ate breakfast less often. For girls with a baseline BMI at the 95th percentile, eating breakfast one more day per week was associated with a significant ↓ of -0.04 (95% CI -0.08, -0.01) in BMI at year 10 (P=0.04), and for those at the 97th percentile, eating breakfast one more day per week was association with a -0.05 (95% CI -0.10, -0.01, P=0.01) ↓ in BMI.
Albertson et al 2009 Study Design: Randomized Controlled Trial	N=650 children (354 boys; 296 girls). 87% white. Location: United	Children, participants in the Dietary Intervention Study in Children, were ages eight to 10 years at baseline, and were followed for 7.5 years, with data collected at baseline,	For the association between days of cereal consumption and BMI, the linear trend was significant in boys (P=0.02) indicating that

Class: A Rating:	States.	years one, three, five and 7.5. Subjects' dietary intake, including cereal and breakfast intake, was assessed at each visit using three non-consecutive 24-hour recalls, with the first completed face-to-face and the second and third via telephone. Height, weight and BMI were assessed at each visit.	lower BMI was associated with more days of cereal consumption. Boys who consumed zero days of cereal had a BMI of 20.4kg/m^2, while boys who consumed three days of cereal had a BMI of 20.1kg/m^2 (P=0.008, d=0.147). The trend for girls was NS. There was also NS association between BMI z scores and frequency of cereal consumption for boys (P=0.18) or girls (P=0.45).
Ask et al 2006 Study Design: Group randomized controlled trial Class: A Rating:	N=54 subjects (26 intervention class; 28 control class). Location: Norway.	All students in 10th grade, consisting of two classrooms, were invited to participate in the study. Students in one class were offered a free breakfast at the beginning of the school day for four months, while students in the second class served as controls. Students completed a FFQ and had their height, weight and BMI measured at baseline and four months.	After the four-month intervention period, weight and BMI ↑ significantly in the control group (P<0.01 for weight, P<0.05 for BMI). There was also a significant ↑ in weight in the males in the intervention group (P<0.05), but not in the females. BMI did not Δ significantly in the intervention group.

Barton BA et al 2005 Study Design: Longitudinal Cohort Study Class: B Rating:	N=2,379 girls, who were non-Hispanic white or black Age: Nine to 10 years at baseline. Location: United States.	Subjects were participants from the nine-year longitudinal National Growth and Health Study. Breakfast intake was determined using annual three-day food records, and height, weight and BMI were measured each year.	Days eating cereal was predictive of BMI z scores as well as risk of overweight ($P<0.01$), but days eating breakfast was not predictive of BMI z scores or weight status ($P>0.17$). For BMI z scores and risk of overweight, girls who ate cereal on three days had lower scores than did girls who ate cereal zero, one or two days ($P<0.05$), while girls who ate cereal zero, one or two days did not differ from one another. BMI z scores ↓ 0.015 for each additional day eating cereal ($P<0.001$). Compared with girls who ate cereal on zero days, girls who ate cereal on one, two or three days were 0.93, 0.90 and 0.87 times as likely to be at risk of overweight, so eating cereal one or more days reduced the risk of overweight.
Berkey, Rockett, et al 2003 breakfast skipping Study Design: Cohort study (longitudinal, prospective) Class: B	N=14,586 adolescents. Age: Nine-17 years. Location: United States.	Subjects were participants in the Growing Up Today Study, which began in 1996 when children were nine to 14 years old. This study investigated data collected in 1996, 1997 and 1998, looking at both cross-sectional and	Overweight children who never ate breakfast lost BMI over the following year compared to overweight children who ate breakfast nearly every day (boys: -0.66kg/m^2; girls: -0.50kg/m^2).

Rating:		longitudinal effects of breakfast on weight. Children self-reported their height and weight annually, BMI was calculated and Δ in BMI over time was determined. An annual questionnaire was used to assess breakfast skipping: Children were asked "How many time each week do you eat breakfast?"	Normal weight children who never ate breakfast gained weight relative to peers who ate breakfast nearly every day (boys: +0.21kg/m^2; girls: +0.08kg/m^2).
Crossman et al. 2006 Study Design: Prospective cohort study Class: B Rating:	N=6,378 subjects (3,144 males; 3,234 females). Location: United States.	Subjects were participants in the National Longitudinal Study of Adolescent Health. This study includes only respondents who participated in Wave One (1995; ages 12-18) and Wave Three (2001-2002; ages 18-26). Height and weight were self-reported at Wave One, and measured at Wave Three and BMI and weight status were calculated. Subjects reported whether or not they eat breakfast.	Skipping breakfast during adolescence predicted male weight in young adulthood, but it was NS for females. Males who skipped breakfast during adolescence were more likely to be overweight or obese six years later (OR=1.37, P<0.05).
Elgar et al 2005 Study Design: Cohort Study Class: B Rating:	N=355 subjects. Mean age at baseline: 12 years. Location: United States.	Participants were from the Health Behavior of School-aged Children Study that took place between 1994 and 1998. Measurements were collected on two occasions four years apart. Height and weight measurements were taken at baseline and year four, and subjects completed a questionnaire at the same time-points that included a question about breakfast	Breakfast skipping reported at baseline was related to BMI at year four. Adolescents who reported skipping breakfast were more likely to have an ↑ in BMI four years later (P<0.05).

		consumption.	
Haines et al 2007 Study Design: Prospective Cohort Study Class: B Rating:	N=2,516 subjects (1,386 girls; 1,130 boys). Location: United States.	Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed-up five years later (2003-2004). BMI was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a FFQ, which included a question regarding the number of days over the past week breakfast was consumed.	For both girls and boys, breakfast consumption at baseline was negatively associated with overweight at year five (girls: OR=0.89, 95% CI 0.83, 0.97; boys: OR=0.89, 95% CI 0.82, 0.97; P<0.05) for both.
Merten et al 2009 Study Design: Prospective cohort study Class: B Rating:	N=7,788 subjects with complete data from Waves Two and Three. Wave Two subjects were adolescents ranging in age from 11-18 years (mean age: 16.1 years). Location: United States.	Subjects were participants in the National Longitudinal Study of Adolescent Health. Subjects were assessed at two developmental time points, adolescence (Wave Two) and young adulthood (Wave Three). Subjects were asked about their frequency of breakfast consumption, and subjects who reported consuming breakfast at least four days a week were considered to be regular breakfast consumers. Self-reported height and weight was used to calculate BMI, and those who were obese during adolescence and young adulthood were considered to have chronic obesity.	Results showed that 59% of adolescents were regular breakfast consumers. Chronic obesity was significantly associated with a ↓ in the likelihood of adolescent breakfast consumption (OR=0.59; 95% CI: 0.52 to 0.68; P<0.001).

Neumark-Sztainer et al 2007 Study Design: Prospective Cohort Study Class: B Rating:	N=2,516 subjects (1,386 girls; 1,130 boys). Location: United States.	Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed up five years later (2003-2004). BMI was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a FFQ, which included a question regarding the number of days over the past week breakfast was consumed.	In girls, frequency of breakfast consumption was associated with ↓ in BMI (-0.11 BMI units, P=0.013). Frequency of breakfast consumption was not associated with BMI in boys.
Niemeier et al 2006 Study Design: Prospectibe cohort study Class: B Rating:	N=9,919 subjects with complete data from Waves Two and Three. Wave Two: Age: 11-18 years; Mean BMI: 22kg/m^2. Wave Three: Age: 18 and 26 years; Mean BMI: 26kg/m^2. Location: United States.	Subjects were participants in the National Longitudinal Study of Adolescent Health. Subjects were assessed at two developmental time points, adolescence (Wave Two) and young adulthood (Wave Three). Subjects were asked about their frequency of breakfast consumption, with responses ranging from zero to seven days per week. Measured height and weight was used to calculate BMI.	Breakfast consumption at Wave Two predicted zBMI at Wave Three (β= -.01, P<0.05). For each additional day of breakfast consumption during Wave Two, zBMI was predicted to ↓ 0.01 at Wave Three (P<0.01). Breakfast consumption and Δ in breakfast consumption accounted for 0.06% of the variance in zBMI at Wave Three.
Rosado et al 2008 Study Design: Randomized Controlled Trial Class: A	N=178 subjects. Age: Six to 12 years. Mean BMI: 24kg/m^2. Attrition rate was 32% after 12 weeks.	Subjects were randomly assigned to one of four different treatments for 12 weeks: 1. One serving of cereal for breakfast 2. One serving of cereal for breakfast and	After 12 weeks, only children who consumed one serving of cereal at breakfast with a nutrition education program had significantly lower body weight (-1.01kg (-1.69, -0.34), P<0.01),

Rating:	Location: Mexico.	another one for dinner 3. One serving of cereal for breakfast and a nutrition education program 4. A non-intervention control group. Compliance with study protocol was assessed via weekly parent interviews, and weight and body composition (bioelectrical impedance) was assessed at baseline and 12 weeks.	lower BMI (-0.95kg/m^2 (-1.71, -0.20), P<0.01) and lower total body fat (-0.71% (-1.71, 0.28), P<0.05), compared with the control group.
Timlin et al 2008 Study Design: longitudinal prospective cohort Class: B Rating: 	N=2,216 subjects (1,215 girls; 1,007 boys). Mean age at baseline: 15 years. Location: United States.	Subjects were from the Project Eating Among Teens (EAT) study, who were recruited in 1998-1999 and followed-up five years later (2003-2004). BMI was determined using self-reported height and weight at baseline and five-year follow-up. Dietary intake data was collected at baseline and year five using a FFQ, which included a question regarding the number of days over the past week breakfast was consumed.	Frequency of eating breakfast was inversely associated with BMI in a dose-response manner (P<0.01). BMI ↑ 1.6±0.16 among daily breakfast-eaters, 2.0±0.09 in intermittent eaters and 2.2±0.19 in those who never ate breakfast. However, after adjusting for psychosocial variables related to weight, this association was no longer significant.
Wengreen et al 2009 Study Design: Prospective cohort study Class: B Rating: 	N=159 subjects (102 women; 57 men). Mean BMI: 23kg/m^2. Location: United States.	Subjects were participants in the Freshmen Health Study. Weight was measured at the beginning and end of the fall semester (August-December 2005). Subjects also completed questionnaires about dietary intake and health-related behaviors during the last six	Participants who gained ≥5% of body weight (N=36) were more likely to eat breakfast regularly (at least four times per week) during their first three months of college than during high school compared to those who did not

		months of high school (January-June 2005), in August 2005 and during their first semester of college (August-December 2005) in December 2005.	gain ≥5% of body weight (P<0.05).

Research Design and Implementation Rating Summary
For a summary of the Research Design and Implementation Rating results, click here.

Worksheets

Affenito SG, Thompson DR, Barton BA, Franko DL, Daniels SR, Obarzanek E, Schreiber GB, Striegel-Moore RH. Breakfast consumption by African-American and white adolescent girls correlates positively with calcium and fiber intake and negatively with body mass index. *J Am Diet Assoc.* 2005 Jun;105(6):938-45.

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